

Chem II - Final Exam REVIEW

Matter:

1. Define the term "matter".

2. Differentiate between an atom, ion and molecule (hint, use their definitions).

Mixtures vs. Pure Substances:

1. Match each separation technique with its appropriate description.

<u>Technique</u>	<u>Description</u>
___ centrifugation	A. components of a mixture separate into layers on their own
___ chromatography	B. solid component of the mixture becomes trapped in a screen, allowing the liquid component to pass through
___ crystallization	C. oil, detergent, or some other chemical is added to a mixture, air is forced through the mixture as a means of stirring, and the desired component is skimmed off the top
___ distillation	D. mixture is spun at high speeds creating a force which pulls heavier solid particles towards the bottom of the container
___ electrolysis	E. the mixture is heated until a liquid component reaches its boiling point and is evaporated, leaving the other component behind
___ filtration	F. the mixture is concentrated and cooled until the solid component slowly forms at the bottom of the container
___ floatation	G. the mixture is applied to a solid support and separated into its components by a solvent which carries the various components up the solid support at different rates
___ settling	H. a process in which an electric current is applied to a sample, decomposing the sample into its component elements

2. State three things that distinguish a pure substance from a mixture (consider nature, properties)

3. Describe what a MECHANICAL MIXTURE is (its nature and properties), provide an example, and state the separation method that should be used to isolate its component parts.

4. How is it possible to determine whether a pure substance is an element or a compound? Provide an example of an element and a compound.

5. How can you determine whether a material is "homogeneous" or "heterogeneous"?

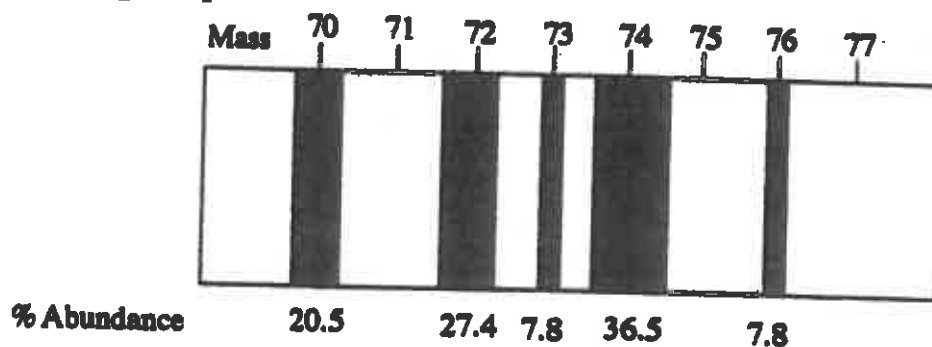
6. Sketch the phase diagram that would be produced when solid nitrogen is heated. Label all states and phase changes.

Atomic Models and Subatomic Particles:

1. Complete the following table.

Symbol	Atomic Mass	Atomic Number	Number of Protons	Number of Neutrons	Number of Electrons
	52	24			24
			15	17	15
	127	52			54
		26		30	23
Ca				21	
Hg ²⁺	201				
			36	47	36
Br ⁻				43	36
Ga ³⁺	70				28
N ³⁻		7		7	

2. An element is analyzed by a mass spectrometer and the following spectrum resulted for the naturally occurring isotopes.



a) Calculate the average atomic mass for this element.

b) What element was analyzed?

c) Write the symbol for the most abundant isotope of this element, including the atomic mass, and the atomic number.

3. Write the core-notation electron configuration for the elements listed below.

Be	_____	Ar	_____
C	_____	V	_____
N	_____	Cu	_____
Na	_____	Ge	_____
S	_____	Br	_____

4. Complete the following table.

Symbol	Number of Protons	Number of Neutrons	Number of Electrons	Electron Configuration
⁷⁰ ₃₁ Ga ³⁺				
³⁷ ₁₇ Cl ⁻				
³⁹ ₁₉ K ⁺				
⁶⁵ ₂₉ Cu ²⁺				
³² ₁₆ S ²⁻				
³⁰ ₁₅ P ³⁻				
⁸⁷ ₃₈ Sr ²⁺				
⁵⁹ ₂₇ Co ²⁺				

5. In the table below briefly summarize the MAJOR contribution(s) the scientist made to our understanding of the atom.

Scientist	Major Contribution(s)
Dalton	
Bohr	
Thompson	
Chadwick	
Rutherford	

Elements and the Periodic Table:

1. What is a period of the periodic table? _____

2. What is a group or family of the periodic table? _____

3. Complete the following table, stating the name of the family (if we named it), the number of valence electrons and the charge on the ions that are usually produced from the elements in the group.

Family Members	Family Name	Number of Valence Electrons	Charge on the Ions Usually Formed
Li, Na, K, Rb, Cs, Fr			
B, Al, Ga, In, Tl			
F, Cl, Br, I, At			
Be, Mg, Ca, Sr, Ba, Ra			
N, P, As, Sb, Bi			
He, Ne, Ar, Kr, Xe, Rn			
O, S, Se, Te, Po			

4. Define the following terms:

a) Atomic Radius:

b) Ionization Energy:

c) Electronegativity:

5. Correctly fill in the blanks below with either "increases" or "decreases"

a) As you move from left to right across the periodic table:

Atomic radius _____

Ionization Energy _____

Electronegativity _____

b) As you move down the periodic table:

Atomic radius _____

Ionization Energy _____

Electronegativity _____

6. a) Which of the following has the LARGEST atomic radius?

i) Li, Na, K, Rb _____

iv) Na^+ , Mg^{2+} , Al^{3+} _____

ii) Na, Mg, Al, Si _____

v) P^{3-} , S^{2-} , Cl^- _____

iii) Mg, Os, Cl _____

vi) N, O, F, Cl _____

b) Which of the following has the LARGEST ionization energy?

i) Li, Na, K, Rb _____

iv) Na^+ , Mg^{2+} , Al^{3+} _____

ii) Na, Mg, Al, Si _____

v) P^{3-} , S^{2-} , Cl^- _____

iii) Mg, Os, Cl _____

vi) N, O, F, Cl _____

c) Which of the following has the SMALLEST electronegativity value?

i) Li, Na, K, Rb _____

iii) Mg, Os, Cl _____

ii) Na, Mg, Al, Si _____

vi) N, O, F, Cl _____

Chemical Bonding:

1.a) Define valence electrons: _____

b) How many valence electrons does each of the following families contain?

i. Alkali metals: _____

v. The Nitrogen family: _____

ii. Alkaline earth metals: _____

vi. The Oxygen family: _____

iii. The Boron family: _____

vii. The Halogens: _____

iv. The Carbon family: _____

viii. The Noble gases: _____

2. Describe what is happening to the electrons involved in a:

a) Covalent bond: _____

b) Polar-covalent bond: _____

c) Ionic bond: _____

3. Name the two types of intermolecular bonds:

_____ and _____

4. Draw the electron dot diagrams and Lewis structures for each of the following:

a) Al

g) SO_3

b) Ca

h) H_2O

c) F

i) C_2H_2

d) S^{2-}

j) CO_3^{2-}

e) CH_3OH

k) N_2

f) BF_3

l) C_2HBr_3

Ionic Compounds:

1) Compare the following properties of both IONIC and MOLECULAR compounds:

- (a) Component elements (metal vs nonmetal)
- (b) Type of chemical bonding (ionic vs covalent)
- (c) Most likely states at room temperature (solid, liquid, gas)
- (d) General trend in melting point temperatures
- (e) General trend in electrical conductivity

2) Write the chemical formulae resulting from the combination of the following ions.

- a) Na^+ O^{2-} _____ c) Sr^{2+} Br^- _____
b) Au^{3+} S^{2-} _____ d) Pb^{4+} $\text{C}_2\text{O}_4^{2-}$ _____

3) Write the correct name for each of the following ionic compounds.

- a) Li_2O _____ c) Mg_3N_2 _____
b) CoCl_3 _____ d) $\text{Cr}_3(\text{PO}_4)_2$ _____

4) Write the correct formula for each of the following ionic compounds.

- a) Cesium iodide _____ d) Aluminum oxide _____
b) Strontium cyanide _____ e) Iron (III) hydroxide _____
c) Copper (I) bicarbonate _____ f) Potassium permanganate _____

5) Write the correct name for each of the following ionic hydrates.

- a) $\text{Cd}(\text{NO}_3)_2 \cdot 4\text{H}_2\text{O}$ _____
b) $\text{NaSCN} \cdot 5\text{H}_2\text{O}$ _____

Acids and Bases:

1. State three properties of acids and three properties of bases. (think back to grade 10)

2. Write the correct names for the following bases.

a. $\text{Ca}(\text{OH})_2$ _____ b. LiOH _____

3. Provide the missing formula or name for the following simple (binary) acids.

a. Hydrofluoric acid _____ c. $\text{H}_2\text{S}_{(\text{aq})}$ _____
b. Hydrobromic acid _____ d. $\text{HI}_{(\text{aq})}$ _____

4. Provide the missing formula or name for the following complex acids.

a. Chromic acid _____ d. $\text{H}_2\text{CO}_{3(\text{aq})}$ _____
b. Sulphurous acid _____ e. $\text{H}_3\text{PO}_{4(\text{aq})}$ _____
c. Hypochlorous acid _____ f. $\text{HNO}_{2(\text{aq})}$ _____

Molecular Compounds:

1. Write the correct name for each of the following molecular compounds.

a. NF_3 _____ d. N_2O_4 _____
b. CO_2 _____ e. SCl_6 _____
c. P_2O_5 _____ f. N_2O _____

2. Write the correct formula for each of the following molecular compounds.

a. Silicon disulphide _____ d. Triarsenic pentabromide _____
b. Carbon tetrachloride _____ e. Dicarbon hexahydride _____
c. Oxygen gas _____ f. Iodine heptachloride _____

Mixed Naming:

1) Provide the correct name for each of the following compounds.

a) CsBr _____ c) H_2SO_4 _____
b) ICl _____ d) $\text{Cu}(\text{NO}_3)_2$ _____

Measurement and Communication:

1. Complete the following table of prefixes.

Factor	Prefix	Abbreviation
10^6	kilo	h
10^1	deci	c
10^{-3}	micro	n
10^{-12}		

2. A student weighed a mass 4 times and obtained the following masses:

25.5g, 29.6g, 23.6g, 27.3g

The actual value is known to be 10.20045g

What can be said about the accuracy and precision of the measurements?

3. Write the following numbers in scientific notation with the same number of significant digits.

a) 0.000005187 _____

b) 7,247 _____

c) 16,140 _____

d) 0.0921 _____

4. Convert the following numbers from scientific notation into decimal form.

a) 4.562×10^6 _____

b) 8.276×10^{-8} _____

5. Complete the following calculations. Include all units and don't forget about sig figs.

a) $1.0068\text{g} + 2.15\text{g} + 8.3\text{g} =$

b) $21.05\text{cm} - 12.1\text{cm} =$

c) $\frac{1.50 \times 10^{-2} \text{ mol}}{40.0\text{mL}} =$

d) $\frac{432.8\text{g}}{21.8\text{cm} \times (7.645\text{cm} - 3.58\text{cm})} =$

6. Convert 12 milliamperes into megaamperes.

7. Convert $42.6\mu\text{mol/mL}$ into mol/L .

8. Determine how many significant figures are in each of the following numbers:

a) 1.00300

e) 0.003050

b) 780.00

f) 7,000,800

c) 0.1110

g) 0.00567

d) 3000

h) 3.000

Mole Conversions:

1. Calculate the MOLAR MASS of the following substances.

a) CuSO_4

b) $\text{Ca}(\text{MnO}_4)_2$

2. Calculate the number of moles of CO_2 that would be present in 8.7×10^{18} molecules of CO_2 .

3. How many grams of Copper would be present in 4.5×10^{-3} moles of Copper?

4. Calculate the mass (in g) of 2.7×10^{21} molecules of ammonia (NH_3).

5. Determine the mass (in grams) of one atom of Silver.

6. How many molecules are in 75.6g of $\text{CH}_3\text{C}(\text{OH})_2\text{CH}_3$?

7. What is the volume occupied by 15mg of $\text{SbH}_3(g)$ at STP?

Percentage Composition, Empirical and Molecular Formulae:

1. Write the empirical formula for each of the following compounds.



2. Calculate the percentage composition by mass of each of the following compounds.



3. Calculate the percentage composition of the bold species in each of the following compounds.



4. a) A compound has the following composition: 24.24% C, 4.04% H and 71.72% Cl. What is the empirical formula of the compound?

b) If the molecular mass of this compound is 99.5 g/mol, what is the molecular formula?

5. The molar mass of a compound is 58g/mol. What is the molecular formula of the compound if the empirical formula is C_2H_5 ?

Molarity Calculations:

1. If a 4.50g sample of solid NaOH is dissolved to make 0.500L of solution, what is the molarity of the solution?

2. How many grams of Na₂CO₃ would be required to produce 400.0mL of 0.600M Na₂CO₃?

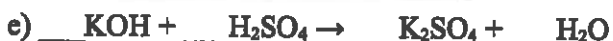
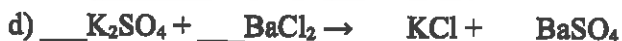
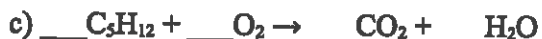
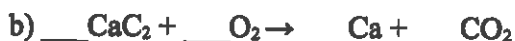
3. If 75.7g of Magnesium chloride are mixed with sufficient water to make a 0.885M solution, what is the volume of the solution?

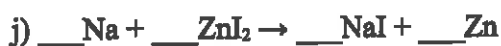
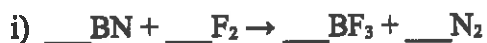
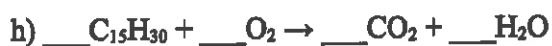
4. How many mL of 16.4 M H₂SO₄ are needed to prepare 755mL of 0.25M H₂SO₄?

Chemical Reactions and Equations:

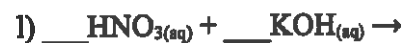
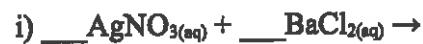
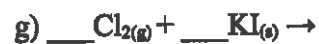
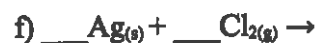
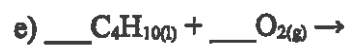
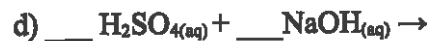
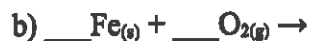
1. Balance and classify the following chemical reactions.

Type of Reaction





2. Classify, complete AND balance the following chemical equations. Type of Reaction



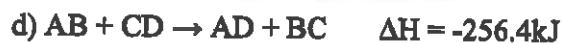
Energy of Reactions:

1. Define ENDOTHERMIC and EXOTHERMIC reactions.

Endothermic: _____

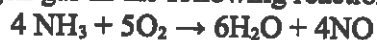
Exothermic: _____

2. Classify the following reactions as either endothermic or exothermic.



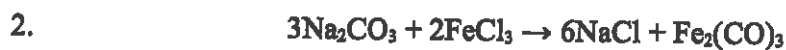
Stoichiometry:

1. Ammonia combines with oxygen gas in the following reaction:



a) How many moles of NH_3 are needed to combine with 3.57 moles of O_2 gas?

b) If 1.5 grams of NO is produced in the above reaction, how many grams of NH_3 were reacted?



a) How many grams of NaCl will be produced from the reaction of 0.080 moles of Na_2CO_3 with excess FeCl_3 ?

b) How many grams of FeCl_3 would be needed to react with 4.2g of Na_2CO_3 ?



a) How many grams of MgCl_2 would be formed if 50.0mL of 0.200M AlCl_3 is reacted with excess Mg?

b) How many mL of 0.150M AlCl_3 would be needed to react completely with 2.00g of Mg?

Excess and Limiting Reagents/Percent Yield:



In a chemical reaction 6.92g of Fe_2S_3 is combined with 4.54g of oxygen gas.

a) Which reactant is the **LIMITING** reagent?

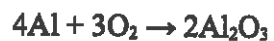
b) How many grams of the **EXCESS** reactant will be left over after the reaction is complete?

c) How many grams of Fe_2O_3 can be formed in this reaction?

2. What mass of P_4 will be produced when 41.5g of $\text{Ca}_3(\text{PO}_4)_2$, 26.3g of SiO_2 , and 7.80g of C are reacted according to the following balanced equation?



3.



a) How many grams of aluminum oxide, Al_2O_3 , would be expected to form in the reaction of 15.0g Al with 18.43g of oxygen gas?

b) If the actual yield of Al_2O_3 produced in the reaction was only 22.4g Al_2O_3 , what would the PERCENT YIELD of the reaction be?

